Dennis (F. S.)

ON THE

TREATMENT OF AMPUTATIONS

BY THE

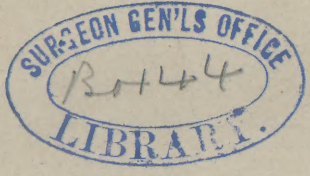
OPEN METHOD.

BY

FREDERIC S. DENNIS, M. D.,

HOUSE-SURGEON, BELLEVUE HOSPITAL.

[*REPRINTED FROM THE NEW YORK MEDICAL JOURNAL, JAN.*, 1876.]



NEW YORK:
D. APPLETON & COMPANY,
549 & 551 BROADWAY.
1876.

THE POPULAR SCIENCE MONTHLY,

(Established May, 1872,)

Conducted by Prof. E. L. YOUMANS.

THE POPULAR SCIENCE MONTHLY was started to promote the diffusion of valuable scientific knowledge, in a readable and attractive form, among all classes of the community, and has thus far met a want supplied by no other periodical in the United States.

The great feature of the magazine is, that its contents are not what science *was* ten or more years since, but what it *is* to-day, fresh from the study, the laboratory, and the experiment: clothed in the language of the authors, inventors, and scientists themselves, which comprise the leading minds of England, France, Germany, and the United States. Among popular articles, covering the whole range of NATURAL SCIENCE, we have the latest thoughts and words of Herbert Spencer, and Professors Huxley, Tyndall, and R. A. Proctor. Since the start, it has proved a gratifying success to every friend of scientific progress and universal education; and those who believed that science could not be made any thing but dry study are disappointed.

The press all over the land is warmly commending it. We subjoin a few encomiums from those recently given:

"That there is a place for THE POPULAR SCIENCE MONTHLY, no one can doubt who has watched the steady increase of interest in scientific investigation manifested in this country, not only by a select class, but by the entire community."—*New York Times.*

"A journal which promises to be of eminent value to the cause of popular education in this country."—*New York Tribune.*

"It is, beyond comparison, the best attempt at journalism of the kind ever made in this country."—*Home Journal.*

"The initial number is admirably constituted."—*Evening Mail.*

"We think it is not too much to say that this is the best first number of any magazine ever published in America."—*New York World.*

"It is just what is wanted by the curious and progressive mind of this country, and ought to be widely circulated."—*New York Evening Post.*

"It is the first successful attempt in this country to popularize science in the pages of a monthly."—*N. Y. School Journal.*

"Not the less entertaining because it is instructive."—*Philadelphia Age.*

"THE MONTHLY has more than fulfilled all the promises which the publishers made in the prospectus of publication."—*Niagara Falls Gazette.*

"It places before American readers what the ablest men of science throughout the world write about their meditations, speculations, and discoveries."—*Providence Journal.*

"This is a highly-auspicious beginning of a useful and much-needed enterprise in the way of publication, for which the public owe a special debt of obligation to Messrs. D. Appleton & Co."—*Boston Gazette.*

"This new enterprise appeals to all who are interested in the laudable effort of diffusing that information which is best calculated to expand the mind and improve the conditions and enhance the worth of life."—*Golden Age.*

"Just the publication needed at the present day."—*Montreal Gazette.*

"This new magazine, in our estimation, has more merit than the whole brood which have preceded it."—*Oswego Press.*

"In our opinion, the right idea has been happily hit in the plan of this new monthly."—*Buffalo Courier.*

"This is one of the very best periodicals of its kind published in the world. Its corps of contributors comprise many of the ablest minds known to science and literature. It is doing a great and noble work in popularizing science, promoting the growth of reason, and leveling the battlements of old superstitions reared in the childhood of our race before it was capable of reasoning."—*The American Medical Journal*, St. Louis, Mo.

"This magazine is worth its weight in gold, for its service in educating the people."—*The American Journal of Education*, St. Louis, Mo.

"This monthly enables us to utilize at least several years more of life than it would be possible were we obliged to wait its publication in book-form at the hands of some compiler."—*The Writing Teacher and Business Advertiser*, New York.

THE POPULAR SCIENCE MONTHLY is published in a large octavo, handsomely printed on clear type, and, when the subjects admit, fully illustrated. Each number contains 128 pages.

Terms: $5 per Annum, or Fifty Cents per Number.

Postage free to all Subscribers in the United States, from January 1, 1875.

A new volume of the POPULAR SCIENCE begins with the numbers for May and November each year. Subscriptions may commence from any date. Back numbers supplied.

Now Ready, Vols. I., II., III., IV., V., VI., and VII., of The Popular Science Monthly, embracing the Numbers from 1 to 42 (May, 1872, to October, 1875). 7 vols., 8vo. Cloth, $3.50 per vol. Half Morocco, $6.50 per vol.

For Sale, Binding Cases for Vols. I., II., III., IV., V., VI., and VII., of The Popular Science Monthly. These covers are prepared expressly for binding the volumes of THE POPULAR SCIENCE MONTHLY as they appear, and will be sent to Subscribers on receipt of price. Any binder can attach the covers at a trifling expense. Price, 50 cents each.

AGENTS WANTED.

ADDRESS *D. APPLETON & CO., Publishers,*
549 & 551 Broadway, New York.

ON THE

TREATMENT OF AMPUTATIONS

BY THE

OPEN METHOD.

BY

FREDERIC S. DENNIS, M. D.,

HOUSE-SURGEON, BELLEVUE HOSPITAL.

[*REPRINTED FROM THE NEW YORK MEDICAL JOURNAL, JAN.*, 1876.]

NEW YORK:
D. APPLETON & COMPANY,
549 & 551 BROADWAY.
1876.

ON THE TREATMENT OF AMPUTATIONS BY THE OPEN METHOD.

Perhaps one of the most weighty and important subjects to which the surgeon can direct his attention is the proper treatment of amputations in hospital practice. In a careful analysis of nearly five thousand cases of amputations performed in hospitals, reported in Sir James Y. Simpson's works, *one* patient in every *three* perished. When such a frightful mortality as this confronts the surgeon, it becomes indeed a subject of the greatest importance for him to investigate, and, if possible, to find out some method of treatment to lessen the mortality. The plan of construction of our large hospitals is, no doubt, faulty, and has largely contributed to this terrible result; still, this is not the only factor at work, for the after-treatment of an amputation is a matter of the greatest importance. The proper dressing of a stump is as essential to the successful issue as the manner in which the member has been removed. For over a year nearly all the amputations in Bellevue Hospital, in the third surgical division, have been treated by the open method, and the results have been so surprisingly successful, for hospital practice, that it is the object of this paper to describe this dressing, and bring it before the surgical profession as the best and safest treatment

for stumps in our large hospitals. This peculiar method of dressing amputations was inaugurated in Bellevue Hospital by Dr. James R. Wood, visiting surgeon to this Hospital, and to him is due all the credit for introducing and carrying into effect this great reform in surgery, which has given such wonderful results on the other side of the water. The frightful mortality that has attended limb-amputations for the past few years in metropolitan hospitals has been such as to intimidate the boldest operator, and stay the hand of the most reckless surgeon. In fourteen consecutive major amputations, performed during Dr. Wood's service within the past year, there has not been a death, although his patients have all occupied the same wards that were vacated a year ago on account of puerperal fever. In addition to these amputations, there have been in these same wards other capital operations, including resections of the knee and elbow joints, and several amputations of the female breast, all of which have done equally as well as the limb-amputations in the continuity and contiguity.

In one case of sub-periosteal resection of elbow-joint, treated openly from the beginning, and in which there was no sloughing, erysipelas, or pyæmia, the temperature only on three occasions rose above 100½° Fahr. In another resection of the knee-joint, only once did the temperature rise to 103° Fahr., and this case was treated in a new apparatus devised by Dr. Fluhrer. In three amputations of the female breast, treated in these same wards, the temperature in each case was below 102° Fahr.

Now to return to the limb-amputations. It certainly speaks well for a peculiar manner of dressing stumps, when the results have been in fourteen consecutive amputations so unprecedented, under circumstances that surgeons would suppose most adverse; and Dr. Wood may well look with profound satisfaction upon this array of successful cases, and feel an honest pride in having revived a method of treating stumps which was unwisely rejected, but which is productive of such excellent results.

The writer will now proceed to describe Dr. Wood's method of dressing stumps in all its details, and refer to the

great advantages that this treatment possesses over that of closing the stump, then reply to a few of the most prominent objections raised by surgeons who are opposed to this manner of treating amputations, and finally publish the individual histories of a few cases illustrating the great benefits of leaving a stump open to the air. The cardinal principle involved in this method of dressing is that of preventing suppurative fever, and this object is best attained, as will be shown, by leaving the stump entirely open, thus allowing of free and continuous drainage. After a limb has been amputated, the flaps are not even approximated, but left entirely open. A pillow of oakum is placed under the stump, which is allowed to rest upon this support until the wound is nearly healed. A small piece of gauze is placed over the contour of the stump, and a cradle is placed over the limb, so that the clothes may not come in contact with the painful extremity. This is all the dressing that is employed; no sutures are used except in the lateral skin-flap method, as will be described. No adhesive plaster is employed, no oil-silk is placed over the stump, no bandage is applied, no dry charpie is stuffed into the wound, no fenestrated compresses are placed between the flaps; in other words, the stump is left entirely alone, just as the surgeon made it in his amputation. The wound is thus allowed to drain freely, and the stump is gently washed at frequent intervals by means of an Esmarch's wound-douche. The water in this irrigator is impregnated with crystals of carbolic acid, and, after this ablution, balsam of Peru (which makes a fine stimulating application) is poured over the granulating surface. The discharge which falls from the wound is removed every few hours in order to secure perfect cleanliness; and it is a fact worthy of observation that this discharge will not decompose when exposed to the open air, but that it requires a warm temperature, such as exists in the stump itself, in order to develop putrefaction. The pus, thus coming away from a nidus of putrefaction which would otherwise be formed, falls upon a piece of sheet-lint where the temperature is cooler, and thus does no harm. The stump is then washed at frequent intervals until suppuration has nearly subsided in

the wound, and then the flaps are gradually approximated by means of strips of adhesive plaster. Too much importance cannot be attached to this method of operating by the lateral skin-flaps. It affords the best facility for free drainage, and makes the most serviceable stump. It is important to dissect the flaps very long, when they are subjected to the open treatment, as shrinkage often follows exposure to atmospheric influences. This lateral-flap method of amputating Dr. Wood has employed for many years in private practice with uniform success. The line of incision is comparable to a Baron Larrey amputation at the shoulder-joint. Dr. Wood has used this style of flaps on the thigh, leg, arm, and forearm, and has in every case found the stump to be a most satisfactory one. In all the cases reported this style of flap has been cut, with one exception, and mention will be made of this in the history of the particular case. Esmarch's elastic bandage has been employed in every case, and in no instance has sloughing, or any other complication, occurred. The stump after a week is capable of being moulded into any shape, which the surgeon's taste may suggest. During the entire healing of the wound the greatest possible care is exercised in reference to the use of the instruments necessary to perform the dressing of the stump. No sponges are ever used in the wards. Each patient has his own bottle of balsam of Peru, and every instrument used in the dressing of one stump is thoroughly washed in carbolic-acid water before it is employed in the dressing of another. So far as has been practicable, a different set of scissors, dressing-forceps, and other instruments employed in the manipulation of a dressing, has been used, so that each patient had his own instruments, and in this way absolute cleanliness is secured. Each dresser invariably washes his hands in carbolic-acid water after dressing one case before undertaking another, and any one who is dressing unhealthy wounds in the pavilion, or making autopsies, is not allowed to even assist in the daily dressing of healthy wounds. To some this red tape may seem absurd and chimerical; and it is certainly true that one must be thoroughly convinced of the necessity of these measures before he can be induced to conscientiously observe them. Now, the great

advantages that are claimed for this method of treatment of stumps, by leaving them entirely open to the air, are:

First. That suppurative fever is very much modified; indeed, it is almost obviated. We know from the most recent researches of surgical pathologists that suppurative fever "is partly due to the blood taking up materials resulting from decomposition of mortified tissue on the substance of the wound, partly to the absorption of material formed by the traumatic or accidental inflammation."[1] If we recognize this generally-accepted theory of secondary fever, we must admit that the severity of the fever must depend upon the nature of the pyogenic material and the special advantages that the absorbents may have in reference, not only to the situation, but also to the extent of the wound. As we have before remarked, if pus is allowed to remain on a granulating surface, with the warm temperature that always exists, this pus will sooner or later decompose, and the products of this decomposition will be absorbed by the wound, and in this way septic material is taken into the system and suppurative fever is developed. If the wound is a large one, and the formation of pus abundant, and the advantages for absorption favorable, it naturally follows that the fever will be one severe in type, and prolonged in character. In leaving the stump open, and allowing the effete material free drainage from the surface of the wound, the most important factor which produces secondary fever is eradicated, the patient escapes the severe constitutional disturbance dependent upon the absorption of decomposed pus from a closed wound, and the discharge, falling below, where there is a cooler temperature, is at once disarmed of its poisonous character.

In the history of every case treated by this open method, the suppurative fever has been almost obviated, notwithstanding the fact that some of the amputations, as is shown by hospital statistics, have been the most fatal in surgery. In all the cases reported, including amputations of the arm, leg, and even thigh, no patient has shown a temperature higher than 103° Fahr., and many of the cases have been, during the entire period of convalescence, with the exception of one or

[1] Billroth.

two nights, below 99½° Fahr. This is a most remarkable record, when we include amputations of the thigh high up, within four inches of the hip joint. Now let us compare this record with that of those patients who have been treated by closing up the stump. In all the cases operated upon for amputation, and treated by the closed method, in this hospital within the past year, there can scarcely be found a patient whose temperature was as low as 103° Fahr.; and this statement includes cases of amputation of the forearm and hand, and in some cases even of the fingers, at the time of suppurative fever. In the major amputations the thermometer has shown a record of 104° Fahr., and, in many cases that have been carefully examined, even above 105° Fahr., and in quite a number even as high as 106°. In one primary amputation of the arm in the upper fourth, treated openly, at the maximum intensity of suppurative fever the thermometer introduced into the mouth did not go above 100½° Fahr., a most remarkable circumstance when we take into consideration the fact that this amputation was within a few inches of the shoulder-joint. In another case of primary amputation of the leg within eight inches of the knee-joint, there was scarcely any constitutional disturbance from suppurative fever, and the temperature, except when the patient suffered from a very severe attack of facial neuralgia, did not go above 99½° Fahr. but on two occasions, and then only as high as 100° Fahr. This is a most astonishing case, when we reflect that the amputation was performed and treated in a large metropolitan hospital. In still another case of amputation at the knee-joint, the temperature, with but three exceptions, did not rise above 99½° Fahr. Do not these cases show at a glance that secondary fever is almost entirely avoided by leaving the stump exposed to the air, and thus substantiate the ground taken in reference to the first advantage of the dressings, viz., that suppurative fever is very much modified—indeed, is almost entirely obviated?

The *second* advantage that is claimed for this peculiar treatment of stumps over other methods that are adopted is, that it prevents all possibility of the formation of abscesses in the vicinity of the stump, which are so apt to form in

closed stumps even when they are most carefully watched. In no case that has been subjected to the open treatment has there occurred an abscess, either in the immediate vicinity of the stump, or in any part remote from the wound. The reasons for this are obvious. The conditions that are necessary to develop an abscess are wanting. There is no opportunity for pus to collect within circumscribed limits, there to decompose, and in this way assist, as it must and does, in the formation of an abscess. This is all prevented by a free and constant drainage from the suppurating wound. Now, in a closed stump, more pus is formed than is necessary to meet the indications required, and it is this superfluous amount of pus that is pent up and there decomposes and produces so much mischief, even though the lower angle of the stump is left open for drainage, and it is a very significant fact that, in almost all the cases that have been treated by the closed method in this hospital within the past year, abscesses are recorded in the history-books as a complication during the process of healing of a stump.

Another great advantage that may be claimed in this connection is the absence of erysipelas in the wound, or in the cellular tissue in the vicinity of the stump. It is conceded by many surgeons that sutures in a stump, and strips of adhesive plaster drawn over the flaps, act in many cases as exciting causes to develop erysipelatous inflammation, or at least predispose the integument and cellular tissue to take on this unhealthy action. Whether this is true or not, the fact still remains the same, that in the cases where the flaps are drawn close together, and silver sutures retain them in apposition, erysipelas is very frequently developed, and inflammation is often quickly arrested by removing the plaster, and especially the sutures. In no case has even an erysipelatous blush appeared in a stump treated openly. These two serious complications, the fearful scourges in hospitals, are thus obviated, or at least the tendency to their development is very much diminished. A careful analysis has been made of every amputation performed in this hospital within the past year, and, in almost every case that has been treated by the closed method, either abscess, erysipelas,

or sloughing, has been a complication, or else the suppurativ fever has been of the most severe type. Now, on the other hand, in all the cases treated by the open method not one of these serious complications has occurred.

Last March two cases were admitted to Bellevue Hospital, both of which required primary amputation. They were sent to Ward 16, where the hygienic conditions which surrounded them were precisely the same. Both men were under the influence of liquor at the time of their admission, and both were addicted to the habit of drinking. They were about the same age, and as far as can be judged were in about the same constitutional condition. As the circumstances are unique, the writer will avail himself of this most remarkable coincidence to illustrate, in a practicable manner, the difference in the treatment of stumps, one by closing the wound, the other by leaving it open. Let us first dwell upon the case that was treated by the closed method. This patient, upon whom an amputation was performed, and whose stump was closed after the operation, was suffering from a compound fracture and dislocation of the ankle-joint, which could not be reduced, although tenotomy has been performed upon the tendo Achillis. A consultation was held, and the surgeons decided that amputation afforded the patient the best chance for his life. Accordingly, an anæsthetic was administered, an Esmarch elastic bandage was applied, and the amputation was performed by the lateral skin-flap method. Soon after the amputation had been performed, the flaps were approximated and brought into beautiful apposition by silver sutures, strips of adhesive plaster were applied to relieve tension in the edges of the flaps, a bandage was neatly put over the stump, and the patient rallied nicely from the shock of the operation. During the evening an anodyne was administered and the patient passed a very comfortable night. The afternoon following the operation Dr. Wood made his usual daily visit to the hospital, and, upon examining the condition of this patient, requested the house-surgeon to remove the dressings from the stump. The flaps were found to be slightly red and œdematous. Dr. Wood ordered several sutures to be removed, that better drainage might be secured. The temperature of the patient

was about 101° Fahr., and he appeared restless and anxious. The next day the erysipelatous blush was well pronounced, and the condition of the stump was not healthy. Several days later there was detected a slight swelling near the crest of the tibia, four inches above the end of the stump, which upon examination was found to have all the characteristics of an acute abscess. An incision gave exit to about two ounces of unhealthy pus. This relieved the patient, and his condition now was a little better. The sutures were still retained in the stump, a few having been removed at different times in order to still better facilitate drainage from the lower angle of the wound. Lotio plumbi et opii was applied externally for several days, and quinine-and-iron was administered in moderate doses. Several days later this patient had a well-pronounced chill. There were signs now of serious constitutional disturbance. His face was flushed, he complained of sickness at the stomach, his pulse was full and strong, his countenance was anxious, and the general aspect of the patient indicated some grave disturbance. His temperature rose to 106½° Fahr., and his respirations were hurried. Quinine was given in twenty-grain doses every three hours during the night, together with stimulants. He was sponged off thoroughly several times during the night with alcohol, and the next morning his temperature was reduced to 100½° Fahr. He passed a bad day, and the prognosis was exceedingly grave. He suffered from delirium, anorexia, and carphologia. His evening temperature was 105° Fahr., and the quinine was continued in large doses, in addition to stimulants and the sponge-bath. Another abscess formed in the vicinity of the stump, which was promptly opened, and gave vent to a considerable amount of pus. His condition at length improved, and he was finally discharged cured.

Let us now refer to the other case, and see what lesson this patient teaches us in reference to treating wounds openly in our large city hospitals. This man was brought to the hospital under the circumstances already mentioned. Upon examination of his injuries, the foot of the right leg was found to be crushed in a most frightful manner. The bones of the metatarsus were fractured and comminuted, and there was

great loss of substance in the soft parts. A consultation was held at the same time as in the case of the other man, and by the same surgeons. The leg was condemned by a unanimous vote, and primary amputation was advised immediately. The operation of election in this case was the circular flap with two vertical lateral incisions, which facilitated turning back the integument and adipose tissue. The patient, after the completion of the operation, was placed in a comfortable bed, opposite to the other man in the same ward. He rallied nicely from the operation, and this case was treated from the beginning in precisely the same manner as has been described. It is wholly unnecessary to give the daily record of pulse, respiration, and temperature, in this case; but it will suffice to add that, exclusive of the natural elevation of temperature during the period of suppurative fever, his record was between 98½° Fahr. and 99½° Fahr. during the entire period of his recovery from an amputation, primary in character, of the leg. His highest temperature was 103° Fahr., which occurred only one evening, and on another evening his temperature was 101½° Fahr. Now, both of these temperatures occurred at the height of suppurative fever, and if we reflect upon the fact that this is not a high temperature for one suffering from secondary fever, and that this elevation only extended over a few hours, is it not remarkable that his record was almost a normal one during a convalescence from a primary amputation of the leg, performed in a large metropolitan hospital? No abscesses formed in the vicinity of the stump, the flaps had not the slightest erysipelatous flush at any time, there was no sloughing of the part, he had no chill, and scarcely any constitutional disturbance. He was ordered to remain in bed a much longer time than was necessary, as his rapid recovery without a bad symptom was discouraging to his companion on the opposite side of the ward.

There is presented in these two cases, *similar* in respect to surroundings, injuries, age, constitution, habits, and operation, but entirely *different* in reference to the treatment of their wounds after amputation, a contrast that is at once striking, as it is unique. It was a rare opportunity to illustrate in a most practicable manner the advantages of one method of treating

stumps after amputation over another. If any exception can be made in reference to the cases selected, nevertheless, the great principle which is involved in treating stumps openly is fully vindicated in the respective histories of these two men. They were brought to the hospital the same afternoon, they were assigned to the same ward, they were operated upon at the same hour, they were treated by the same surgeon, they were subjected to precisely the same amputation, they were surrounded by the same hygienic conditions, they were both hard drinkers and intoxicated at the time, facts which have an important bearing in estimating the results of a severe surgical operation. A careful analysis of the cases in this hospital shows the highest temperature reached in suppurative fever by those whose stumps were treated openly to be about equal to the very lowest temperature during fever in any of the cases in which the stumps have been closed. The average temperature at the height of suppurative fever of those cases treated by the closed method is nearly 104° Fahr., and, in every case, abscess, sloughing, erysipelas, or pyæmia, has intervened, and in a very great many even death. Do not these facts point to something significant in the dressing of a stump? are they not calculated to arrest the attention of every thinking and honest surgeon? and will they not throw some light upon the dark subject of the fatality of hospital amputations?

In the cases that are now to be reported, no selection has been made that would include the best; but every amputation on the third surgical division is given in chronological order, from the time at which the two amputations above described were performed. It is obvious that a limit must be made, and the writer has selected this period from which to report every case in its order. In the amputations that occurred before this date, some were treated openly with the most satisfactory results, others were treated by the closed method. A sufficient number of cases will now be reported to illustrate practically the many advantages that have been claimed in this paper for this method of dressing stumps; also to prove that the objections that are raised against this plan of treatment are unfounded, and to show that they will not bear the crucial test of experience.

Before giving the histories of the cases treated by the open method, it may be well at this point to reply to a few of the most prominent objections raised by those who are opposed to this plan of dressing.

1. It is strenuously urged by those who advocate closing the wound, and particularly those who adopt the *Maisonneuve* or pneumatic occlusion method, that the atmospheric influences exert a baneful effect upon the open wound. This opinion, which has been entertained for some years by eminent surgeons, has been proved by experience to be incorrect. On the contrary, certain varieties of wounds do best when they are exposed to atmospheric influences. Billroth says, in the latest edition of his work on "Surgical Pathology," that "free air does no harm to the wound; imprisoned air is very dangerous." He further adds that a wound treated openly from the start has no bad smell, unless large shreds upon it become gangrenous. "The idea that air was injurious to a wound," says this learned pathologist, "rests chiefly upon the observation that the entrance of air to abscess cavities with rigid walls, and into serous sacs, usually induces suppuration." He states also that "we must attribute much blame to the fact that in the pus-sacs the air is warmed, and impregnated with watery vapor from the pus; this inclosed air now becomes a true hatching-place for those minute organisms which cause decomposition, and which are always more or less present in the atmosphere." No such reasoning is, of course, applicable in the case where the flaps are left open to the air, for the air here is not pent up in a cavity, and the temperature is the same as the surrounding medium. That the products of putrefaction are irritating and poisonous to a wound, all will readily concede; but, in a stump which is suppurating, there is a granulating surface in itself constituting a protecting layer, which resents the absorption of the poison. If a stump is closed, and air is not permitted to gain access to the wound, the discharge which collects remains pent up, and this forms a nidus for putrefaction; but, if left open, the effete material is carried off by the free and constant drainage.

Pasteur first demonstrated that oxygen was not the cause of putrefactive suppuration, but that it was a species of fer-

mentation produced by microscopic organisms which float in the air. As soon as it was understood that this change was due to fermentation, at once it was clearly seen by surgeons that any agent that would destroy the vitality of these little atmospheric organisms, without injuring the tissues themselves, would permit of wounds being treated openly. Now, we know by experience that in carbolic acid we have one of the most potent remedies in overcoming this objection, for this acid will completely destroy the septic energies of any of these low forms of life. In accordance with this view, the wounds were left open to the air, for any deleterious effects arising from atmospheric influences could at once be obviated by this powerful remedy. It was for this reason that the stumps treated by the open method have done so surprisingly well, and those that have been closed have done so badly. In addition to the destruction of these germ-poisons by carbolic acid, we know that this application has an anæsthetic effect upon the tissues with which it comes in contact, and not an irritating influence, as some surgeons have been prone to think.

2. It is objected that, if a suppurating wound is left open, there will be formed a bed for flies and other insects to deposit their eggs, and thus a long train of evil consequences would follow. Now, if it were true that flies by depositing their eggs could produce certain low forms of life on a granulating surface, this one circumstance alone would justify a surgeon in completely abandoning such a dressing; but, happily, experience and close observation have proved to us the absurdity of this objection. It is a fact well known among surgeons that flies and other insects are apt to creep into dressings and deposit their eggs; but it is a fact just as well known among careful observers, that flies will not deposit their eggs upon a healthy granulating surface. So, whatever may be the reason for this singular circumstance, the fact remains a true clinical one, and shows that flies, even in warm weather, do not render the treatment of stumps by the open method impossible.

3. It is objected that flaps thus exposed to the air have a tendency to slough. There is no reason why they should slough, and many reasons can be assigned to show why they

should not. By reference to notes taken at the time of the individual cases to be reported, it appears that in not a single case did sloughing of the whole or part of the flaps occur. In carefully examining the cases that have been treated by the closed method, it is surprising to find how few recovered without sloughing of part of the flaps, and in a few cases the entire flaps are reported to have sloughed. The risk of secondary hæmorrhage is mentioned by some as an argument against this dressing. In no case has it occurred, although the ligatures have come away as early as the fifth day. In one case there was an intermediary hæmorrhage; but this was immediately observed and arrested, without the trouble of taking out the sutures and searching for a bleeding point. Mention will be made of this in one of the cases to be reported.

Case II. Service of Dr. James R. Wood. *Compound Comminuted Fracture of Radius and Ulna, involving Elbow-Joint.*—J. G., aged twenty-eight, married, liquor-dealer, was admitted to Bellevue Hospital, March 29, 1875. The family history is of no special importance. Patient gives a history of venereal disease, and states that for the last few years he has been a hard drinker. On the night of his admission to the hospital he was riding upon the front platform of a street-car, and fell off, the wheels passing over his arm. Upon examination, there was found a compound comminuted fracture of the forearm, involving the elbow-joint, and extending upward above the condyles. There was also great laceration of the soft parts above the elbow-joint, with considerable loss of substance over the anterior aspect of the arm. Dr. Wood saw the case, and amputation was performed the same evening, the arm being removed a few inches below the shoulder-joint. The stump was left open, and the edges of the flaps were not even approximated by strips of adhesive plaster. He passed a very good night, and reacted nicely from the shock of the operation. The wound was dressed from the beginning in precisely the same manner as has been described in this paper. The daily temperature in this case will not be reported, and it will suffice to state that, for twelve days after the operation, his temperature was below 100° Fahr., with the exception of three evenings, during which time he was suffering from suppurative fever. At the maximum intensity of fever his temperature only rose to the low point of 100½° Fahr., which is a remarkable temperature for a patient who is at the highest point of suppurative fever, following an amputation of the

arm within a very few inches of the shoulder-joint. This patient made a rapid and successful recovery, and left the hospital at an early date.

Case III. Service of Dr. J. R. Wood.—L. D., aged twenty-five, admitted September 17, 1875. This patient was sent by a French naval surgeon from the man-of-war Minerva, to have his left thigh amputated. He was a sailor in the active discharge of duty, and was injured by the anchor-chain. At the time of his admission he was suffering greatly from shock, consequent upon his injuries and loss of blood. Upon a thorough examination of the case, there was found a compound comminuted fracture of the femur, involving the knee-joint. The leg and foot of the same side were cold and cyanotic. The finger introduced into the wound on the inner aspect of the thigh came in immediate contact with the articulating cartilages of the knee-joint. The soft tissues of the leg were contused, but no bones were broken. After a consultation was held, it was decided to operate at once, as this gave the man the best chance for his life. The vessels having been secured, the stump was left resting on a pillow of oakum, with the flaps open. No sutures were employed, no adhesive plaster was applied, but the stump was left open, exposed to the air in exactly the same manner that has already been described in this paper. The patient did not react well after this severe operation, and remained in a precarious condition for many hours. Every thing was done to resuscitate the man. He was in a state of collapse; a hot-air bath was administered; his extremities were thoroughly rubbed with tincture of capsicum, sinapisms were applied over the epigastrium, and cloths wrung in hot water and alcohol were placed over his abdomen. Brandy was given freely hypodermically every few minutes for the first hour after the operation. After a number of hours he began to react, and at two o'clock on the following afternoon he had rallied from the shock of the amputation. On the evening after the operation, unusually severe, owing to the peculiar character of the accident, the great delay in the operation, the necessity of transporting him from the French man-of-war in the bay to the hospital, and the shock which attended the injury, his temperature was 98½° Fahr., his pulse 130, and his respirations 30 to the minute. Notwithstanding traumatic fever following so severe an accident, and suppurative fever after so grave an operation, his temperature rose to 103° Fahr. but once during the entire period of his recovery, and this was his zenith temperature at the height of suppurative fever in a primary amputation of the thigh high up, within five inches of Poupart's lig-

ament. On the twelfth day after the operation his temperature was 98½° Fahr., having been below 100° for several days previous to this date. Four evenings following, it rose above 100° Fahr., but the ten days after it ranged between 99° Fahr. and 100° Fahr. The ligatures came away in due season, the flaps after a week from the operation were gradually brought into apposition by means of strips of adhesive plaster, and the stump healed in a most beautiful manner. The patient was out of bed at an early date, and has been presented with an artificial limb which was given to him by his fellow-countrymen residing in this city, through the kind efforts of Dr. Allen, house-physician in Bellevue Hospital.

Case IV. Service of Dr. James R. Wood.—R. W., aged forty-six, widow; domestic. Admitted to Ward 13, September 15, 1875. This patient came to Bellevue as a private patient of Dr. Wood. Nearly one year ago she was run over by a street-car, and received a compound comminuted fracture of the fibula with dislocation of the ankle-joint. The lower end of the tibia was resected, and she remained in a very precarious condition for many weeks. Her leg had many sinuses, which after a while closed, leaving the limb in a bad condition. In addition to the fracture of the fibula just above the external malleolus, there was another fracture of the bone a few inches below the styloid process of the fibula. The lower fracture was compound, but the upper one was simple. She recovered from these injuries with a useless organ of locomotion; the limb was fully three inches shorter than the one on the opposite side, the foot was falsely anchylosed in the extended position, and the fibrous tissue intervening between the lower end of the tibia and the astragalus gave rise to a severe attack of erysipelas upon the slightest motion. She was unable after eight months to bear any appreciable weight upon the foot, and there was necrosis of the bones of the tarsus. After a consultation of surgeons it was decided to remove the useless limb, and thus afford her a good stump for an artificial limb. At her request the operation was performed, and was made at the knee-joint, the lowest point of election, owing to the condition of her leg after her injuries. The patella was left, as it was not diseased, and it filled up the trochlear space, thus beautifully preserving the contour of the stump. The external flap was made a little longer than the internal, to counterbalance the difference between the two condyles of the femur. The flaps were left entirely open, with the exception of two sutures at the beginning of the vertical incision, so as to cover over the end of the femur, and attain primary union for two or three inches, and thus have a linear

cicatrix over a part of the anterior aspect of the stump. These long skin-flaps were allowed to rest upon a pillow of oakum, and free drainage was thus secured. In the report of the case, the record of the daily temperature and the condition of the stump will be omitted for obvious reasons, and a short *résumé* will be given which will enable one at a glance to comprehend the progress of the case up to the time of complete recovery. The highest temperature that this patient had during her convalescence was 102¾° Fahr., and this was at the maximum intensity of suppurative fever. From this time for twelve days following, her temperature rose but on two occasions above 99½° Fahr. She had no marked constitutional disturbance, no abscesses, no erysipelas, but made a most rapid and satisfactory recovery. On the twentieth day after the amputation she was out of bed, and she has now entirely recovered from the operation.

Case V. Service of Dr. James R. Wood.—A. M., aged thirty-four. Admitted October 16, 1875. This patient was brought to the hospital by the ambulance. Family history is uncertain, and his personal history is good as regards his general health. He acknowledges that he has had venereal disease, and also states that he has been a drinker for a number of years. Patient says that two hours before his admission he fell from a shed on to the pavement, a distance of sixteen feet, and that he struck with the whole weight of his body on his right leg. Upon admission, the patient was found to be a strong, healthy man. He was not suffering from shock, although there had been considerable hæmorrhage from the open wound. Upon examination, there was found a compound comminuted fracture of the tibia and fibula, about six inches above the ankle-joint. The finger of the surgeon introduced into the wound could be swept around for some distance subcutaneously, and sharp spicules of bone could be felt. The calf of the leg was very much infiltrated with blood, and, from the alarming hæmorrhage which occurred upon removing the compresses, it was supposed that the anterior tibial artery was ruptured. At one o'clock the same day, a consultation was held, and the result was a decision in favor of primary amputation. The incision was begun about eight inches below the knee-joint. The man rallied nicely from the shock of the amputation, and the flaps were left open as described. Two silver sutures were introduced at the beginning of the incision in order to cover over the medullary canal. The stump was treated essentially the same as the other cases. If exception is made to a rise of temperature that took place one night during a severe attack of facial

neuralgia, which occurred also at the height of the secondary fever, this case gives the astonishing record of a temperature scarcely above 99½° Fahr. during the entire period of his recovery. The ligatures came away early, the stump has healed nicely, and the man has made a most speedy recovery. There is presented in this case a primary amputation, following an injury which produced a compound comminuted fracture, with a record as excellent as it is rare. When records show that the statistics of this operation in hospital practice give a fatality of one in every two and a half, this report certainly speaks well for this method of dressing the stump. The patient is now entirely recovered, and did not have a bad symptom.

Case VI. Service of Dr. James R. Wood.—T. M., aged twelve. Admitted November 12, 1875. This boy states that he has enjoyed the best of health all his life. Seven hours before his admission, while patient was playing, he attempted to jump on a train of cars belonging to the Hudson River Railroad Company, and he slipped, the wheels passing over his foot, crushing it in a most frightful manner. Upon examination, the following injuries were found: The integument was stripped off from the entire dorsal surface of the left foot, the ankle-joint was opened, and there was a compound dislocation of the cuboid and external cuneiform bones at the tarso-metatarsal articulation, and the phalanges were extensively comminuted. Dr. Wood, after examining the foot, decided that amputation afforded the boy the best chance for his life. The leg was removed six inches above the ankle-joint by the lateral skin-flap method, and one or two silver sutures were introduced at the upper angle of the incision for the reasons already assigned.

A flap of periosteum was enucleated from the shaft of the tibia, in order to cover over the medullary canal, a procedure that Dr. Wood has adopted for many years. The spine of the tibia was removed by a pair of gnawing bone-forceps, to prevent the crest of the tibia from ulcerating through the integument over the anterior aspect of the stump. The patient was placed in bed immediately after the operation, the vessels having been secured by the ligature. At one o'clock in the morning the house-surgeon was hastily summoned by an attendant in the ward, who announced that the patient was bleeding. The femoral artery was compressed, and upon arrival of the house-surgeon there was found a large clot of blood upon the oakum. A careful examination was made of the stump, which was easily done, as every thing was exposed to view, and this examination failed to detect any bleeding

point. The compression of the femoral artery was discontinued, and no further trouble was experienced.

There was no further trouble during the night, and the patient rested well. Space will not permit of a daily note of the progress of this little boy; it is, however, worthy of mention that, on the sixth day after this severe operation, he sat up in bed, and appeared cheerful and happy. On the seventh day every ligature came away without any force, and the flaps were now brought into apposition, and a beautiful stump was moulded from day to-day.

Case VII. Service of Dr. James R. Wood.—M. Q., aged twenty. Admitted December 1, 1875, 5.45 P. M. This patient was injured by machinery. Upon examination, there were found severe burns of the first and second degree upon her arms and left leg, a severe sprain of the shoulder-joint, and a compound fracture of the right tibia with extensive laceration of the soft parts. The tibia was denuded of its periosteum for a considerable distance, and the tendons of the tibialis anticus, peroneus tertius, and extensors, were hanging from the open wound. Dr. Wood carefully examined the case, condemned the leg, and amputation was performed at once. The incision was begun just below the insertion of the quadriceps extensor. The patient rallied nicely from the operation and made a most satisfactory recovery. Notwithstanding the fact that she was suffering from peripheral irritation due to burns and from a severe attack of dysmenorrhœa, at the maximum of suppurative fever, the thermometer did not rise higher than 102° Fahr. She sat up in bed on the sixth day after the operation, and her temperature was 98½° for three following mornings.

MEDICAL WORKS

PUBLISHED BY D. APPLETON & CO.

Anstie on Neuralgia. 1 vol., 12mo. Cloth, $2.50.
Bartholow's Treatise on Therapeutics. (In press.)
Barker on Puerperal Diseases. 1 vol. Cloth, $5.00.
Barker on Sea-Sickness. 1 vol., 16mo. Cloth, 75 cents.
Barnes's Obstetric Operations. 1 vol., 8vo. Cloth, $4.50.
Bellevue and Charity Hospital Reports. 1 vol., 8vo. Cloth, $4.00.
Bennet's Winter and Spring on the Mediterranean. 1 vol., 12mo. Cloth, $3.50.
Bennet on the Treatment of Pulmonary Consumption. 1 vol., 8vo. Cloth, $1.50.
Billroth's General Surgical Pathology and Therapeutics. 1 vol., 8vo. Cloth, $5.00; Sheep, $6.00.
Bastian on the Common Forms of Paralysis from Brain Diseases. $1.75.
Bulkley's (L. D.) Acne; its Pathology, etc.
Combe on the Management of Infancy. 1 vol., 12mo. Cloth, $1.50.
Carpenter's Mental Physiology. $3.00.
Chauveau's Comparative Anatomy of the Domesticated Animals. Edited by George Fleming, F. R. G. S., M. A. I. 1 vol., 8vo, with 450 Illustrations. Cloth, $6.00.
Davis's (Henry G.) Conservative Surgery. Cloth, $3.00.
Dickson on Medicine in Relation to the Mind. Cloth, $3.50.
Elliot's Obstetric Clinic. 1 vol., 8vo. Cloth, $4.50.
Ecker's Convolutions of the Brain. $1.25.
Flint's Physiology. 5 vols. 8vo. Cloth, per vol., $4.50; Sheep, $6.00.
Flint's Manual on Urine. 1 vol., 12mo. Cloth, $1.00.
Flint's Relations of Urea to Exercise. 1 vol., 8vo. Cloth, $2.00.
Frey's Histology and Histo-Chemistry of Man. Cloth, $5.00.
Hoffmann's Manual of Medicinal Chemicals. Cloth, $3.00.
Hammond's Diseases of the Nervous System. 1 vol., 8vo. Cloth, $5.00.
Hammond's Physics and Physiology of Spiritualism. 1 vol., 12mo. Cloth, $1.00.
Holland's (Sir Henry) Recollections of Past Life. 1 vol., 12mo. Cloth, $2.00.
Howe on Emergencies. 1 vol., 8vo. Cloth, $3.00.
Howe on the Breath, and the Diseases which give it a Fetid Odor. Cloth, $1.00.
Huxley on the Anatomy of Vertebrated Animals. 1 vol. Cloth, $2.50.
Huxley and Youmans's Physiology and Hygiene. 1 vol., 12mo. Cloth, $1.75.
Hammond's Insanity in its Relations to Crime. 1 vol., 8vo. Cloth, $1.00.
Hammond's Clinical Lectures on Diseases of the Nervous System.
Hamilton's (A. McL.) Electro-Therapeutics. 1 vol., 8vo. Cloth, $2.00.
Johnston's Chemistry of Common Life. 2 vols., 12mo. Cloth, $3.00.
Letterman's Recollections of the Army of the Potomac. 1 vol., 8vo. Cloth, $1.00.
Lewes's Physiology of Common Life. 2 vols., 12mo. Cloth, $3.00.
Markoe on Diseases of the Bones. 1 vol., 8vo. Cloth, $4.50.
Maudsley on the Mind. 1 vol., 8vo. Cloth, $3.50.
Maudsley's Body and Mind. 1 vol., 12mo. Cloth, $1.00.
Maudsley on Responsibility in Mental Disease.
Meyer's Electricity. 1 vol., 8vo. Cloth, $4.50.
Niemeyer's Practical Medicine. 2 vols., 8vo. Cloth, $9.00; Sheep, $11.00.
Neftel on Galvano-Therapeutics. 1 vol., 12mo. Cloth, $1 50.
Nightingale's Notes on Nursing. 1 vol., 12mo. Cloth, 75 cents.
Neumann on Skin Diseases. 1 vol., 8vo. Cloth, $4.00.
New York Medical Journal. $4.00 per annum. Specimen copies, 25 cents.
Paget's Clinical Lectures and Essays. 1 vol., 8vo. Cloth, $5.00.
Peaslee on Ovarian Tumors. 1 vol., 8vo. Cloth, $5.00.
Pereira's Materia Medica and Therapeutics. 1 vol., 8vo. Cloth, $7.00; Sheep, $8.00.
Sayre's Club-Foot. 1 vol., 12mo. Cloth, $1.00.
Schroeder on Obstetrics. 1 vol., 8vo. Cloth, $3.50.
Steiner's Compendium of Children's Diseases. Cloth, $3.50.
Stroud's Physical Cause of the Death of Christ. 1 vol., 12mo. $2.00.
Swett on Diseases of the Chest. 1 vol., 8vo. Cloth, $3.50.
Simpson's (Sir Jas. Y.) Complete Works. Vol. I. Obstetrics and Gynæcology. 8vo. Vol. II. Anæsthesia, Hospitalism, etc. 8vo. Vol. III. The Diseases of Women. Per vol., Cloth, $3.00; Sheep, $4.00.
Tilt's Uterine Therapeutics. 1 vol., 8vo. Cloth, $3.50.
Van Buren on Diseases of the Rectum. 1 vol., 12mo. $1.50.
Van Buren and Keyes's Genito-Urinary Diseases, with Syphilis. Cloth, $500; Sheep, $6.00.
Vogel's Diseases of Children. 1 vol., 8vo. Cloth. $4.50; Sheep, $5.50.
Wells on Diseases of the Ovaries. 1 vol., 8vo. Cloth, $5.00.
Wagner's Chemical Technology. 1 vol., 8vo. $5.00.
Walton's Mineral Springs of the United States and Canada. With Analyses and Notes on the Prominent Spas of Europe. Cloth, $2.00.

*** Any of these works will be mailed, post-free, to any part of the United States, on receipt of the price. Descriptive Catalogue forwarded on application.

A large and carefully-selected stock of Medical Works, American and Foreign, constantly on hand.

Special Terms given on large orders.

Physicians are invited to send their names and addresses.

D. APPLETON & CO., Publishers, 549 & 551 Broadway, New York.

FOR 1876.

APPLETONS' JOURNAL,

A HOUSEHOLD WEEKLY MAGAZINE,

DEVOTED TO

Popular Literature, and all Matters of Taste and General Culture.

APPLETONS' JOURNAL *aims to be comprehensive, including in its plan all branches of literature, and treating all subjects of interest to intelligent readers; it designs to be elevated in taste and pure in tone; it gives in quantity fully twenty-five per cent. more than the largest of the monthly magazines, while in quality its literature is of the highest class.*

Writers and Features for 1876.

Among the contributors and features for the ensuing year, we are at present enabled to announce the following, premising that other features will be added, and other writers included, as circumstances permit:

JULIAN HAWTHORNE.—Mr. Hawthorne, whose "Saxon Sketches" have been among the most brilliant and pungent essays of the time, will give a series of graphic delineations of London Suburban Life.

ALBERT S. RHODES.—This accomplished essayist will appear in papers on social life and foreign incidents.

CHRISTIAN REID.—Stories and sketches from this accomplished Southern writer will appear.

ALBERT F. WEBSTER.—Stories, and descriptive sketches of Far-Western places, are expected from Mr. Webster's graphic pen.

JUNIUS HENRI BROWNE.—Mr. Browne's brilliant society sketches will frequently appear.

M. E. W. S.—This accomplished writer will continue her sparkling papers on social topics, and her eminently picturesque stories.

KAMBA THORPE.—"Little Joanna," by this author, who is a Southern lady, was one of the most charming novels of 1875. Contributions from her pen will appear.

EDGAR FAWCETT.—Mr. Fawcett's poems are remarkable for their picturesque and graphic power. He will contribute short stories as well as poems.

MRS. KATHARINE S. MACQUOID (author of the famous novel, "Patty") will send from abroad, specially for the JOURNAL, stories and descriptive sketches.

NORA PERRY.—This graceful writer will contribute regularly to our columns.

ALFRED H. GUERNSEY (for many years editor of *Harper's Magazine*) will contribute papers on distinguished names in literature.

MAURICE THOMPSON.—This gentleman's papers of adventure in Florida have been one of the attractions of the JOURNAL. Similar sketches are expected from his pen.

GATHERINGS FROM AN ARTIST'S FOLIO.—Mr. James Freeman, an American artist who has resided for thirty years in Rome, and during that time met many of the most distinguished men and women of the period, will give, under the above title, his reminiscences and experiences, which are of the most entertaining character.

HORACE E. SCUDDER.—Mr. Scudder's "Heirs of the Bodley Estate" is one of the best of recent short stories. Similar original and graphic productions may be looked for.

LUCY H. HOOPER.—Mrs. Hooper's charming letters from Paris will be continued.

CONSTANCE FENIMORE WOOLSON.—Poems will appear from this delightful writer, and stories may also be looked for.

THE CENTENNIAL.—Papers will appear illustrating the progress and development of the country in its first hundred years.

TRANSLATIONS.—Paul Heyse is acknowledged to be the best writer of short stories in Germany; translations from his productions, and also from other noted French and German authors, will occasionally be given.

ILLUSTRATIONS.—Illustrations will be given, but, as the main purpose is to furnish a first-class literary periodical, engravings will hold a secondary place.

THE EDITOR'S TABLE (in which are discussed social and current themes); BOOK REVIEWS, and notes about authors; THE ARTS (surveying the entire field of painting, sculpture, architecture, decorative art, household art, music, the stage, etc., etc.); SCIENCE, INVENTION, AND DISCOVERY—these Departments will be conducted with the thoroughness that has hitherto caused them to be recognized as distinguished features of the JOURNAL.

Published Weekly. Price, 10 cents per Number; or $4.00 per Annum, in Advance.

By the recent Post-Office Law, the postage on all periodicals must be prepaid by the publishers. Subscribers, therefore, will hereafter receive their numbers without expense of postage.

To CLUBS: One extra copy will be given to a club of five subscribers; or, for twenty dollars, six yearly subscriptions.

Subscriptions will be received for six months, at same rate as for the year.

Volumes begin with January and July of each year.

For those who prefer it, the JOURNAL is put up in MONTHLY PARTS, and in this form its scope and variety, as compared with other magazines, become conspicuously apparent. Subscription price, $4.50 per annum, including postage prepaid by the publishers.

D. APPLETON & CO., Publishers, New York.